

ST. MARYS RIVER, MICH.

LETTER

FROM

THE SECRETARY OF WAR

TRANSMITTING

A LETTER FROM THE CHIEF OF ENGINEERS, UNITED STATES ARMY, DATED MARCH 17, 1941, SUBMITTING A REPORT, TOGETHER WITH ACCOMPANYING PAPERS AND ILLUSTRATIONS, ON REEXAMINATION OF GREAT LAKES CONNECTING CHANNELS, WITH A VIEW TO DETERMINING IF IT IS ADVISABLE TO PROVIDE ADDITIONAL LOCKAGE FACILITIES AT ST. MARYS FALLS CANAL, MICH., REQUESTED BY RESOLUTION OF THE COMMITTEE ON RIVERS AND HARBORS, HOUSE OF REPRESENTATIVES, ADOPTED FEBRUARY 11, 1941

MAY 21, 1941.—Referred to the Committee on Rivers and Harbors and ordered to be printed with 2 illustrations

WAR DEPARTMENT,
Washington, May 19, 1941.

THE SPEAKER OF THE HOUSE OF REPRESENTATIVES.

DEAR MR. SPEAKER: I am transmitting herewith a report dated March 17, 1941, from the Chief of Engineers, United States Army, on reexamination of Great Lakes connecting channels, with a view to determining if it is advisable to provide additional lockage facilities at St. Marys Falls Canal, requested by resolution of the Committee on Rivers and Harbors, House of Representatives, adopted February 11, 1941, together with accompanying papers and illustrations.

The Bureau of the Budget has been consulted and advises that in view of the relation of the project to the national defense there would be no objection to the submission of the proposed favorable report to the Committee.

Sincerely yours,

HENRY L. STIMSON,
Secretary of War.

WAR DEPARTMENT,
OFFICE OF THE CHIEF OF ENGINEERS,
Washington, March 17, 1941.

The CHAIRMAN, COMMITTEE ON RIVERS AND HARBORS,
House of Representatives, Washington, D. C.

MY DEAR MR. CHAIRMAN: 1. The Committee on Rivers and Harbors of the House of Representatives, by resolution adopted February 11, 1941, requested the Board of Engineers for Rivers and Harbors to review the reports on Great Lakes Connecting Channels, submitted in River and Harbor Committee Document No. 53, Seventy-fourth Congress, first session, and previous reports, with a view to determining if it is advisable to provide additional lockage facilities at St. Marys Falls Canal; also with a view to making such other modifications in the project as may be considered advisable at this time. I enclose the report of the Board in response thereto. A separate report will be made regarding other modifications in the project.

2. After full consideration of the reports secured from the district and division engineers, the Board recommends that the project for the Great Lakes connecting waters, principal harbors, and river channels, be modified to provide for a new lock 800 feet long, 80 feet wide, and 30 feet deep, at St. Marys Falls, Mich.; for deepening of the upper and lower approach channels to 27 feet; and for alteration of the piers and approach walls; all substantially as shown on the accompanying drawing and with such modifications as may be found desirable by the Chief of Engineers; at an estimated cost of \$8,000,000 for new work, and \$100,000 annually for maintenance and operation in addition to that now required.

3. After due consideration of these reports, I concur in the views and recommendations of the Board.

Very truly yours,

J. L. SCHLEY,
*Major General,
Chief of Engineers.*

REPORT OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

WAR DEPARTMENT,
THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS,
Washington, March 3, 1941.

Subject: Great Lakes—Connecting waters, principal harbors, and river channels.

To: The Chief of Engineers, United States Army.

1. This report is on the matter of providing additional lockage facilities at St. Marys Falls Canal and is in response to part of the following resolution, adopted February 11, 1941. A separate report will be made regarding other modifications in the project.

Resolved by the Committee on Rivers and Harbors of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors created under section 3 of the River and Harbor Act, approved June 13, 1902, be and is hereby, requested to review the reports on Great Lakes Connecting Channels, submitted in River and Harbor Committee Document numbered 53, Seventy-fourth Congress, first session, and previous reports, with a view to determining if it is advisable to provide additional lockage facilities at St. Marys Falls Canal;

also with a view to making such other modifications in the project as may be considered advisable at this time.

2. St. Marys River is 63 miles long and flows southeasterly from Lake Superior to Lake Huron. It has a fall of 21 to 23 feet, nearly all of which is concentrated at St. Marys Falls at the head of the river. Channel improvement by the Federal Government since 1857 has resulted in navigable depths to accommodate vessels drawing 20 feet when up-bound and 24 feet when down-bound. For the passage of vessels around the falls two canals with four parallel locks have been built on the United States side and one canal with one lock on the Canadian side. The existing project for St. Marys River provides for channels through shoals between Lake Superior and the head of the falls, having minimum widths of 1,000 feet with depths at low-water datum of 27 feet through Round Island Shoals and Middle Ground and 26 feet through Vidal Shoals; for widening Brush Point Turn to a bottom width of 1,200 feet and the channel from Brush Point to Point Louise to a bottom width of 1,000 feet; for constructing and operating four locks, two canals, and an emergency dam for each of the canals at the falls; for deepening and widening the tailrace of the United States power plant; for constructing remedial works at the inlet of the power canal of the Michigan Northern Power Co.; for constructing compensating works at the falls; for dredging through shoals between the lower end of the canals and the upper entrance to Lake Nicolet, including extension of anchorage and maneuvering area below the locks and widening of angle at black gas buoy No. 33; for dredging to widen and deepen the upper entrance channel into Lake Nicolet; for excavating channels from Lake Nicolet to Lake Munuscong on either side of Neebish Island, a distance via West Neebish of 14 miles and via Middle Neebish 15 miles, the Middle Neebish, or up-bound, route to have a least width of 500 feet, and the West Neebish, or down-bound, route 300 feet; and for dredging shoals between Lake Munuscong and the mouth of the river. The cost for new work to February 1, 1941, was \$34,905,248 and for maintenance was \$10,581,826. The approved estimate for annual cost of maintenance is \$450,000, of which \$374,000 is for operation and care of the St. Marys Falls canals and locks.

3. The commerce through St. Marys Falls canals during the past 20 years has varied from a low of 20,000,000 tons in 1932 to a maximum of 93,000,000 tons in 1929 and averaged for the period 66,700,000 tons per year. It consisted principally of iron ore and grain which moved from Lake Superior ports to the lower lake ports and bituminous coal which moved from Lake Erie ports to Lake Superior. During 1940 the commerce amounted to 89,858,000 tons, of which 77,061,728 tons were down-bound. The down-bound movement of iron ore amounted to 66,226,030 tons. Up-bound and down-bound vessel trips totaled 20,837.

4. A large portion of the commerce is carried in ships of a standard type, 600 feet in over-all length, 60-foot beam and capable of loading to a draft of 21 feet or more. The Poe, Weitzel, and Canadian locks, all constructed many years ago, have inadequate depth for most of the vessels now engaged in the lake trade, leaving Davis and Fourth locks with depth of 23.1 feet at low-water datum to pass the bulk of the traffic. In 1940 the commerce passed through Davis and Fourth

locks was 87,328,000 tons and through Poe and Canadian locks 575,000 and 1,955,000 tons, respectively.

5. The Lake Carriers' Association, representing owners and operators of deep-draft vessels, requests the construction of a new lock about 860 feet long, 80 feet wide, and 30 feet deep on the site of the Weitzel lock which is now unserviceable. It points out that the reasonable capacity of the present facilities is being reached, that the crippling of one lock would have serious results when traffic is at the high levels, and that a new lock is required due to inadequate depth in the existing locks. The International Shipmasters' Association considers that a new and deeper lock is a much needed improvement at this time. It also points out that serious delays would be inevitable if one of the existing locks were put out of commission by an accident, making it impossible for the vessels to handle the enormous tonnage of iron ore and other essential commodities required by the national defense program.

6. The district engineer proposes the construction of a new lock 800 feet long, 80 feet wide, and 30 feet deep to replace the Weitzel lock, with necessary changes in the approaches. He notes that the controlling depth of 23.1 feet in the present locks is inadequate for the loading of vessels to the full draft permitted by the recently completed down-bound channels of 25-foot depth. Furthermore, the present facilities have a capacity of only 100,000,000 tons, an amount which may be reached during the next navigation season due to the large movement of iron ore required for the national defense program. In view of the delays in shipping which could occur if one of the large locks were put out of commission by an accident, he is of the opinion that the locks do not afford reasonable assurance for uninterrupted transportation of war materials. The cost of the new lock is estimated as \$6,534,000 for construction and \$100,000 per year for maintenance and operation. It would benefit existing commerce by the elimination of congestion and loss of time awaiting lockage, it would permit deeper loading of vessels, and give assurance of adequate locking capacity for reasonably prospective traffic. He is of the opinion that these benefits fully justify the expenditures required for the new lock. The division engineer concurs.

VIEWS AND RECOMMENDATIONS OF THE BOARD OF ENGINEERS FOR RIVERS AND HARBORS

7. The Board concurs with the reporting officers. The commerce of the St. Marys Falls Canal exceeds in volume the total tonnage of the Panama and Suez Canals and is of sufficient importance in both peace and war times to warrant adequate and modern lockage facilities. There is no question as to the justification for the reconstruction of one of the locks at this time. A usable length of 800 feet in the lock chamber would be slightly greater than that of the lock chambers of the Welland Canal and would be adequate for any vessel likely to be used in lake service. The approach channels should be excavated at this time to 27 feet, with 1 foot overdepth. The Board is of the opinion that the cost estimate should be increased to \$8,000,000 to provide for this excavation, rising construction costs, and contingencies. In the opinion of the Board it is desirable that the work be undertaken and completed at the earliest possible date to facilitate the

transportation of commodities required by the national-defense program. The Board accordingly recommends that the project for the Great Lakes connecting waters, principal harbors, and river channels be modified to provide for a new lock 800 feet long, 80 feet wide, and 30 feet deep, at St. Marys Falls, Mich.; for deepening of the upper and lower approach channels to 27 feet; and for alteration of the piers and approach walls; all substantially as shown on the accompanying drawing and with such modifications as may be found desirable by the Chief of Engineers; at an estimated cost of \$8,000,000 for new work, and \$100,000 annually for maintenance and operation in addition to that now required.

For the Board:

THOMAS M. ROBINS,
Brigadier General, Corps of Engineers,
Senior Member.

REEXAMINATION OF ST. MARYS FALLS CANAL, MICH.

SYLLABUS

The district engineer finds that the existing lockage facilities at St. Marys Falls Canal, Mich., have become inadequate, in that full advantage of the deep-draft channel improvements already provided elsewhere cannot be realized until a deeper lock is provided at the canal, and it is imperative in the interests of national defense that an additional lock be provided as a precaution against possible interruption of the movement of iron ore and other commodities in Great Lakes commerce essential to the munitions industries that would result from destruction, or injury to, the existing locks by accident, sabotage, or hostile military action. He recommends, therefore, that the existing project for the Great Lakes—connecting waters, principal harbors, and river channels—be modified to provide for the construction of a new lock, 800 feet long, 80 feet wide, and 30 feet deep, on the site of the present Weitzel lock at St. Marys Falls, Mich.; for the deepening of the upper and lower approach channels to 25 feet; and for the reconstruction of the south pier, from the upper end of the lock to Magazine Street, of the nose piers between the Weitzel and Poe locks, and of the east pier in the lower approach channel; at an estimated cost of \$6,534,000 for new work of construction and \$100,000 annually for increased operation and care of St. Marys Falls Canal.

WAR DEPARTMENT,
UNITED STATES ENGINEER OFFICE,
Detroit, Mich., February 26, 1941.

Subject: Review of reports on Great Lakes—Connecting waters, principal harbors, and river channels.

To: The Chief of Engineers, United States Army.
[Through the Division Engineer, Great Lakes Division, Cleveland, Ohio.]

AUTHORITY

1. This report is submitted in compliance with the following resolution adopted February 11, 1941:

Resolved by the Committee on Rivers and Harbors of the House of Representatives, United States, That the Board of Engineers for Rivers and Harbors created under section 3 of the River and Harbor Act, approved June 13, 1902, be, and is hereby, requested to review the report on Great Lakes Connecting Channels, submitted in River and Harbor Committee Document Numbered 53, Seventy-fourth Congress, first session, and previous reports, with a view to determining if it is advisable to provide additional lockage facilities at St. Marys Falls Canal; also with a view to making such other modifications in the project as may be considered advisable at this time.

2. On February 13, 1941, the Chief of Engineers authorized the submission of a report on additional lock installation at St. Marys Falls Canal in advance of report covering such other modifications in the project as may be considered advisable. In the interest of brevity, the report authorized by the resolution quoted in paragraph 1 is divided into two parts, and this first part is confined to the consideration of improvement of the locks at Sault Ste. Marie, Mich., referred to herein as the Soo locks.

NATURE OF REPORTS BEING REVIEWED

3. The reports being reviewed are the review report published in River and Harbor Committee Document No. 53, Seventy-fourth Congress, first session, under date of May 31, 1935, and previous reports.

4. House Committee Document No. 53 considered improvement at six localities along the steamship lanes between Lake Superior and the lower lake ports, including three localities on the St. Marys River. Improvement of the Soo locks was not considered. The report dealt principally with the widening of natural channels and the removal of shoals in order to remove existing hazards and delays to deep-draft navigation. The Chief of Engineers concurred in the recommendation of the Board of Engineers that the project for the Great Lakes—connecting waters, principal harbors, and river channels—be modified to provide in general for the construction of a separate down-bound channel across Harsens Island at the Southeast Bend in St. Clair River to a depth of 25 feet; for the removal of Poe Reef Shoal in South Channel of the Straits of Mackinac to a depth of 27 feet; and for the widening of Brush Point Turn, in upper St. Marys River, and the channel from Brush Point to Point Louise. The act of August 30, 1935, authorized these improvements, with the exception of the channel across Harsens Island at Southeast Bend.

DESCRIPTION AND TRIBUTARY AREA

5. The locality under consideration is comprised of the watersheds of Lakes Superior, Michigan, Huron, Erie, and Ontario, and the connecting channels thereof. The geographical description of the watershed of the Great Lakes and the general description of the locality are given in House Document No. 253, Seventieth Congress, first session, in the preliminary examination and survey report dated April 26, 1928. Since the date of that report the enlargement of the Welland Canal connecting Lake Ontario and Lake Erie has been completed and the through channels between Lake Superior and Lake Erie have been deepened to accommodate vessels drawing 20 feet when up-bound and 24 feet when down-bound. The general locality of the Great Lakes is shown on United States Lake Survey Charts Nos. 0, 5, 43, and 63. Details of the locality considered herein are shown on map file No. D. S. M. 2/132, accompanying this report.

BRIDGES

6. The North and South Canals, which constitute the west approach to the Soo locks at St. Marys Falls, are crossed by two movable spans of the Minneapolis, St. Paul & Sault Ste. Marie Railway bridge connecting with the International Bridge to Sault Ste. Marie, Ontario. The spans are listed in the following table:

Location	Kind	Draw openings, clear width			Clear head-room above mean low water, bridge closed	Condition of draws for passage
		Right	Left	Center		
		<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	
South Canal.....	Swing.....	108	108	-----	15.5	Clear.
North Canal.....	Bascule.....	-----	-----	282	13.7	Do.

PRIOR REPORTS

7. In the following table are listed prior reports which have been made within the past 40 years with reference to proposed improvements to the Great Lakes connecting waters:

Locality	Nature of report	Date of report	House or Senate	Published in—			Printed in Annual Report of Chief of Engineers	Recommendation
				Number of document	Number of Congress	Session of Congress		
Connecting waters, Chicago, Duluth, and Buffalo.....	Examination.....	Dec. 4, 1890	House.....	207	51	2	1891, p. 2810...	Favorable.
Detroit River, Amherstburg Channel.....	Survey.....	June 4, 1900	do.....	712	56	1	1900, p. 4015...	Do.
Connecting waters, Lake Superior to Lake Huron.....	do.....	Dec. 1, 1900	do.....	128	56	2	1901, p. 3200...	Do.
Detroit River, Amherstburg Channel.....	do.....	Dec. 2, 1904	do.....	40	58	3	1905, p. 2292...	Do.
Connecting waters, Lake Superior to Lake Huron.....	do.....	Jan. 7, 1905	do.....	215	58	3	1905, p. 2289...	Do.
St. Marys Falls Canal, Davis lock.....	do.....	Dec. 20, 1906	do.....	333	59	2	.....	Do.
Connecting waters, Chicago, Duluth, and Buffalo.....	do.....	Nov. 15, 1906	do.....	266	59	2	.....	Unfavorable.
St. Marys Falls Canal, fourth lock.....	do.....	Dec. 16, 1910	do.....	64	62	1	.....	Favorable.
Lake Michigan, Grays Reef Passage.....	do.....	Apr. 3, 1914	do.....	883	63	2	.....	Do.
Great Lakes, harbors and connecting waters.....	Preliminary examination.	Oct. 22, 1917	do.....	755	65	2	.....	Unfavorable.
St. Marys Falls Canal.....	do.....	Oct. 29, 1920	(1).....	.....	.....	.....	.....	Favorable.
Connecting waters, Duluth to Buffalo.....	do.....	Mar. 10, 1926	House.....	270	69	1	.....	Do.
Great Lakes, harbors and connecting channels.....	do.....	Apr. 26, 1928	do.....	253	70	1	.....	Do.
Lake Huron, channel between Mackinac Island and Round Island.....	do.....	Dec. 8, 1931	do.....	2	72	1	.....	Do.
Channels in Lake St. Clair.....	do.....	do.....	do.....	3	72	1	.....	Do.
Great Lakes, St. Lawrence Waterway.....	Survey.....	Jan. 10, 1934	Senate.....	110	73	2	.....	Do.
Lake Michigan, Grays Reef Passage.....	Review.....	Aug. 21, 1934	House committee.	5	74	1	.....	Do.
Great Lakes, harbors and connecting channels.....	do.....	May 31, 1935	do.....	53	74	1	.....	Do.

¹ District engineer's report.

8. In addition to the reports listed above, several reports have been submitted with reference to the improvement of specific harbors and of through channels and parts thereof. A report on compensation or regulatory works was made by the Board on Deep Waterways from the Great Lakes to New York Harbor in 1900, and published in House Document No. 149, Fifty-sixth Congress, second session. The report recommended the construction of regulating works at the head of Niagara River designed to hold Lake Erie to a substantially uniform level. The above report was reviewed in 1910 in a report (H. Doc. No. 779, 61st Cong., 2d sess.) by the International Waterways Commission. A report on the diversion of water from the Great Lakes and the Niagara River, made by Col. J. G. Warren in 1919, in accordance with a resolution of Congress, and printed by the Committee on Foreign Affairs, House of Representatives, Sixty-sixth Congress, recommended the construction of compensating works in the Niagara and St. Clair Rivers to correct the result of existing diversions. A report made in 1926 by the joint board of engineers appointed by the United States and Canada to report on questions relating to the improvement of the St. Lawrence River, printed in Senate Doc. No. 183, Sixty-ninth Congress, second session, considered the question of regulating and compensating works on the Great Lakes. The report found that the construction of regulating works for the benefit of lake navigation was not economically justified at that time, as the cost of securing an increase in navigable depth by this means greatly exceeded the cost of obtaining such increase by dredging. The Board found, however, that it was advisable to construct certain compensating works in the Niagara and St. Clair Rivers to counteract the effect of all diversions and outlet enlargements on the levels of Lakes Michigan, Huron, and Erie.

EXISTING PROJECT

9. The existing project for the Great Lakes connecting waters between Lake Superior and Lake Erie provides for depths in the down-bound channels (including all two-way channels) suitable for vessels drawing 24 feet, and where separable upbound channels are provided, depths suitable for vessels drawing 20 feet, when the lake stages correspond to the established datum planes. The characteristic features of the improvements included in the existing project are described on pages 1676 (St. Marys River), 1682 (St. Clair River), 1685 (Channels in Lake St. Clair), and 1688 (Detroit River) of the

1939 Annual Report of the Chief of Engineers. The project depths and widths at the controlling localities are as follows:

Locality	Up-bound		Down-bound	
	Project width	Project depth	Project width	Project depth
St. Marys River:	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>	<i>Feet</i>
West approach of North Canal.....	500	21	280	24
Middle Neebish.....				
St. Clair River:				
Southeast Bend.....	800	20	600	25
Stag Island, East Channel.....				
Detroit River:				
Shoals at head of Detroit River.....	600	21	800	25
Amherstburg Channel.....				

¹ The up-bound channels in Great Lakes connecting channels are intended, by authority of Congress, to have a controlling project depth of 21 feet. In the vicinity of Stag Island a 2-way channel, 1,000 feet wide and 25 feet deep, to the west of the island was authorized, but this channel is not now being used as a 2-way channel. Down-bound traffic is routed through the channel west of the island and up-bound traffic is routed through a channel passing east of the island. This east channel has a project depth of only 20 feet over a width of 800 feet but has an actual depth of 21 feet over a width of 450 feet.

10. In addition to the river channels, the existing project for St. Marys River provides for the construction and operation of four locks, two canals, and an emergency dam for each of the canals. The following table shows the principal features of the four locks, all of which are located at Sault Ste. Marie, Mich.:

	Weitzel lock	Poe lock	Davis lock	Fourth lock
Miles above mouth.....	47	47	47	47.
Clear width of chamber.....feet.....	80	100	80	80.
Length between miter sills.....do.....	515	800	1,350	1,350.
Lift.....do.....	21.7	21.7	21.7	21.7.
Depth on upper breast wall.....do.....	15.8	21.8	24.3	24.3.
Depth on lower breast wall.....do.....	11.2	16.6	23.1	23.1.
Foundation.....	Rock	Rock	Rock	Rock.
Type of construction.....	Masonry	Masonry	Concrete	Concrete.
Estimated cost.....	\$1,160,000	\$4,738,865 ²	\$6,200,000 ³	\$3,275,000 ⁴
Actual cost.....	\$983,335	\$2,837,337 ⁵	\$2,200,000 ⁶	\$1,750,000 ⁷
Completed ⁸	Sept. 1, 1881	Aug. 3, 1896	Oct. 21, 1914	Sept. 18, 1919.

¹ At low water, 601.1 above and 579.4 below.

² Includes cost of deepening and enlarging South Canal.

³ Includes cost of North Canal.

⁴ Includes canal excavations to provide necessary approaches to lock, canal walls, and piers, and emergency dam.

⁵ Excludes cost of deepening and enlarging South Canal, \$1,653,378.

⁶ Excludes cost of North Canal, \$2,572,611.

⁷ Excludes cost of canal excavations to provide necessary approaches to lock, canal walls and piers, and emergency dam, \$662,919.

⁸ Opened to commerce.

NOTE.—The limiting draft to the locks is determined by the depth over the breast walls.

11. With the exception of the compensating works in St. Clair River the existing project has been completed. The total costs to February 1, 1941, of the channels between Lake Superior and Lake Erie were:

	New work	Maintenance	Total
St. Marys River.....	\$34,905,247.63	\$1,563,301.85	\$36,468,549.48
St. Clair River.....	3,162,332.23	541,410.12	3,703,742.35
Channels in Lake St. Clair.....	4,192,781.97	1,171,747.89	5,364,529.86
Detroit River.....	23,674,024.06	447,914.84	24,121,938.90
Total.....	65,934,385.89	3,724,374.70	69,658,760.59

In addition to the above listed costs, a total cost of \$9,018,524.74 was incurred in the operation and care of St. Marys Falls Canal and locks. The latest approved estimates for annual cost of maintenance of the connecting channels are:

St. Marys River.....	\$450,000
St. Clair River.....	33,500
Channels in Lake St. Clair.....	20,000
Detroit River.....	43,400
Total.....	546,000

The estimated annual cost of \$450,000 for maintenance of St. Marys River includes \$374,000 for operation and care of the St. Marys Falls Canal and locks.

LOCAL COOPERATION

12. Local cooperation has never been required in the improvement of the connecting channels of the Great Lakes, because of the general nature of the benefits that accrue from the through waterway.

OTHER IMPROVEMENTS

13. The Lake Carriers' Association, under permits from the Secretary of War, has performed some work of minor improvement in the through channels. In 1917, approximately 210 cubic yards of boulders were removed by the association from the channel through Vidal Shoals, St. Marys River; and in 1922, approximately 348,911 cubic yards of material were dredged by the same agency from the Middle Ground at Port Huron for the purpose of widening the down-bound channel there.

14. The Canadian Canal, $1\frac{1}{2}$ miles long, 150 feet wide, and 23 feet deep, was built on the north side of the river in the years 1888 to 1895. The Canadian lock is 900 feet long, 60 feet wide, and has 16.8 feet of water over the miter sills at present low water datum. The lock was opened to navigation on September 9, 1895.

TERMINAL AND TRANSFER FACILITIES

15. In the reports under review, there was no special requirement on the part of the Federal Government with respect to additional facilities of this nature, and no such requirements are considered necessary in connection with the improvements now being considered. The construction and improvement of such facilities by private interests has always kept pace with the improvement of the Lake channels.

IMPROVEMENT REQUIRED

16. The specific improvements required at the St. Marys Falls Canal are:

(a) A new lock, 800 feet long, 80 feet wide, and 30 feet deep, on the site of the present Weitzel lock and its approaches.

(b) Deepening of the approach channels to the proposed new lock to a depth of 25 feet.

(c) Reconstruction of the piers along the approach channel to the proposed new lock.

17. Because of the general nature of the benefits that accrue from provisions of the Great Lakes connecting channels, and in order to expedite the submission of this report, a public hearing was not held in connection with this review. However, the Lake Carriers' Association and the International Shipmasters' Association of the Great Lakes were invited to express their views in the matter by letter. Copies of letters¹ received from these interests, expressing their opinion that the proposed additional lock should be provided, are submitted herewith. These organizations represent the great majority of owners and operators of deep-draft vessels on the Great Lakes. The Lake Carriers' Association recommends the construction of a lock 860 feet long similar in dimensions to the locks in the Welland Canal. The Welland Canal locks have a length between inner gates of about 860 feet and a usable length of 765 feet. The lock recommended herein measures 800 feet between inner gates and has a maximum usable length of about 750 feet. An investigation of recorded lengths and drafts of all vessels of American and foreign registry, discloses that the maximum length of any vessel drawing 28 feet or less is about 650 feet. An inquiry addressed to a local shipyard discloses that none of several large new lake freighters on which they are preparing designs and estimates exceed 650 feet in length. It appears, therefore, that an 800-foot lock will accommodate all ships of record drawing 28 feet or less, and all existing and projected bulk lake carriers. Also, the Welland Canal locks have single gates, whereas the lock recommended herein will have double gates; and, by using only one of these gates (the lower gate), the usable length of the 800-foot lock, as recommended herein, will be sufficient to pass any vessel that can pass through the Welland Canal locks.

18. Justification for an additional lock at St. Marys Falls Canal is based upon two separate and distinct reasons:

First.—A lock deeper than those now provided is necessary in order to conform with the channel improvements for 24-foot down-bound navigation already existing in the connecting channels of the Great Lakes; and, inasmuch as the economies that are to be realized from the existing 24-foot draft in the down-bound connecting channels would accrue primarily to iron-ore shipments moving from Lake Superior to the lower lakes, full advantage of the deep-draft channel improvements already provided elsewhere cannot be realized until a deeper lock is provided at the St. Marys Falls Canal.

Second.—In the interests of national defense it is imperative that an uninterrupted supply of iron ore and other commodities in Great Lakes commerce that are essential to the munitions industries can be shipped to the bases of manufacture. Provision of the proposed new lock will not only provide the deeper draft necessary for most eco-

¹ Not printed.

nomical and expeditious movement of these essential commodities but will also provide an additional safety factor against possible interruption to commerce through the canals resulting from destruction, or injury to, the existing locks, by accident, sabotage, or hostile military action.

COMMERCE

19. In the report under review, a statement (table I) was submitted showing the commerce through the St. Marys Falls Canals for the period 1926 to 1933, inclusive. Table I submitted herewith continues the statement to include the year 1940. Table II herewith shows the tonnage of freight passing through each of the active locks of the St. Marys Falls Canals during each year of the 15-year period from 1926 to 1940, inclusive. The Weitzel lock was not in commission during this period.

TABLE I.—Statement of commerce through both American and Canadian canals at Sault Ste. Marie, Michigan and Ontario, for the years 1934 to 1940

Year	Total passages	Net registered tonnage	Passengers	Coal	Flour	Wheat	Grain (other than wheat)	Structural steel and scrap iron
				<i>Tons</i>	<i>Barrels</i>	<i>Bushels</i>	<i>Bushels</i>	<i>Tons</i>
1934	11,399	35,794,600	33,636	10,408,029	6,162,297	173,033,726	46,498,900	183,901
1935	12,960	41,566,253	32,937	9,161,730	6,840,720	179,603,288	43,106,702	290,223
1936	16,615	55,769,283	40,785	12,486,283	6,566,427	162,678,395	50,075,772	367,323
1937	19,982	68,391,220	47,253	13,092,888	6,289,360	117,229,103	50,191,831	498,681
1938	11,201	30,147,671	41,552	9,113,980	6,548,330	174,161,741	90,264,301	175,829
1939	17,075	56,627,786	40,501	9,036,306	7,486,620	250,521,698	86,585,835	494,318
1940	20,837	72,651,395	53,129	10,269,860	6,905,920	224,182,345	62,630,802	625,490

Year	Iron ore	Lumber	Oil	Stone	General merchandise	Total freight	Total value
	<i>Tons</i>	<i>M ft., b. m.</i>	<i>Tons</i>	<i>Tons</i>	<i>Tons</i>	<i>Tons</i>	
1934	22,945,299	169,529	527,916	157,856	902,703	42,248,131	\$620,060,128
1935	29,283,943	193,757	584,540	502,417	1,116,372	48,293,308	688,004,883
1936	47,081,669	204,789	562,823	673,364	1,310,135	69,528,600	799,786,656
1937	65,616,328	270,071	624,829	712,438	1,250,671	87,633,699	925,644,409
1938	20,054,598	268,448	758,419	390,436	1,003,348	40,042,739	581,521,592
1939	46,803,691	316,924	1,012,863	524,841	1,144,664	69,850,262	829,597,173
1940	66,226,030	390,618	1,042,931	693,838	1,321,570	89,858,319	1,926,568,604

¹ Tentative value subject to revision.

TABLE II.—Freight tonnage through American and Canadian locks at St. Marys Falls since 1926

Year	Poe lock	Davis lock	Fourth lock	Canadian lock	All locks
1926	492,681	34,321,373	49,444,286	1,420,747	85,679,087
1927	836,803	32,934,772	48,110,914	1,471,575	83,354,064
1928	2,152,147	33,743,164	49,089,806	2,007,880	86,992,997
1929	3,614,916	36,037,355	50,590,508	2,379,238	92,622,017
1930	1,469,581	28,337,624	41,399,219	1,691,328	72,897,752
1931	519	16,129,619	26,256,620	2,226,913	44,613,671
1932	(1)	14,508,071	3,638,897	2,333,905	20,480,873
1933	4,578	15,281,419	22,747,444	2,274,452	40,307,893
1934	71	14,753,460	25,766,873	1,727,727	42,248,131
1935	0	17,156,702	29,204,224	1,932,382	48,293,308
1936	109,581	28,102,562	39,038,753	2,277,704	69,528,600
1937	491,685	38,777,852	46,547,156	1,817,006	87,633,699
1938	(1)	13,597,981	24,177,292	2,267,466	40,042,739
1939	1,082,843	27,975,735	38,014,957	2,776,727	69,850,262
1940	575,089	40,738,371	46,589,482	1,955,377	89,858,319

¹ Not in commission.

20. Plate I¹ herewith shows, in graph form, the freight tonnage passing through each of the locks of the St. Marys Falls Canals during each year of the 30-year period from 1910 to 1940, inclusive. From the graphs on plate I it is apparent that the annual commerce through the canals has ranged from a low of about 20,000,000 tons, in the depression year of 1932, to a maximum of about 93,000,000 tons, in the boom year of 1929; and that the fluctuations in the graph of this commerce follow very closely the trend of general business conditions throughout the country. It is particularly to be noted that the improvement in business conditions in 1937, which was not considered as of major magnitude in the economic history of the country, was reflected in the commerce through the canals by a sudden increase in freight tonnage to an amount almost as great as that passed during the year 1929, when general business conditions throughout the country and the volume of commerce through the Soo locks, both, were at their maximum of record. In this connection it also should be noted that the volume of commerce passing through the Soo locks in 1940 was within 3 percent of the 1929 maximum, although general business conditions in 1940 reflected only partially the stimulus that may be expected to result from the national-defense procurement program during the next several years. There is every reason to believe, therefore, that commerce through the Soo locks during the next several years will exceed the peak of 1929 and will tax the existing lockage facilities beyond their capacity.

21. Plate II,¹ herewith, shows, in graph form, the number of passengers passing through the St. Marys Falls Canals during each year of the 30-year period from 1910 to 1940, inclusive. It will be noted that more than half of the 20,000 to 80,000 passengers that annually pass through the canals are carried through the Canadian canal. This is explained by the fact that passenger traffic through the canals consists mainly of summer cruise passengers carried by Canadian package freighters, which usually stop at Sault Ste. Marie, Ontario, and pass through the more convenient Canadian lock.

TABLE III.—*Trips and drafts of vessels through United States and Canadian locks (1936 to 1940, inclusive)*

Draft in feet	Trips through United States and Canadian locks ¹				
	1940	1939	1938	1937	1936
23.....	213	20	18	22	(²)
20 to 22.....	4,246	3,074	1,488	4,266	941
18 to 20.....	4,189	3,487	2,074	3,919	5,411
16 to 18.....	4,231	3,551	2,157	4,007	3,297
14 to 16.....	3,516	2,791	1,629	3,424	2,897
12 to 14.....	1,394	1,159	863	1,070	877
Less than 12.....	3,048	2,984	2,972	3,274	3,193
Total.....	20,837	17,075	11,201	19,982	16,615
Total net registered tonnage.....	72,651,395	56,627,086	30,147,671	68,391,220	55,769,283

¹ For break-down of trips and drafts as to direction of movement and type of vessel see part II of Annual Report of Chief of Engineers for following year. Break-down for 1940 shown in table IV herewith.

² Project for 24-foot navigation in down-bound channels was completed in fall of 1936.

¹ Not printed.

VESSEL TRAFFIC

22. Table III, herewith, shows the trips and drafts of vessels through the St. Marys Falls Canals for each year of the 5-year period from 1936 to 1940, inclusive. The immediate and marked increase in draft of vessels passing through the canals after the completion of the project for 24-foot navigation in the down-bound channels, in the fall of 1936, is apparent from this table. This table also shows the marked increase in the number of passages at drafts in excess of 22 feet that accompanied the increase in freight tonnage through the canals in 1940. Table IV, herewith, shows the trips and drafts of vessels through the canals during the season of 1940, subdivided to show the types of the vessels and the direction of movement.

TABLE IV.—*Trips and drafts of vessels through the American and Canadian canals at St. Marys Falls during 1940*¹

WEST-BOUND						
Draft (feet)	Steamers	Motor vessels	Sailing	Barges	Motor-boats, unregistered, etc.	Total
23.....						
20 to 22.....						
18 to 20.....	1, 265	8		14		1, 287
16 to 18.....	3, 516	58		3		3, 577
14 to 16.....	3, 075	2		4		3, 081
12 to 14.....	792	23		1		816
Less than 12.....	538	253		278	489	1, 658
Total.....	9, 186	344		400	489	10, 419
Total net registered tonnage.....	34, 868, 218	451, 891		1, 010, 931	700	36, 331, 740
Passengers:						
Excursion ²						13, 930
Regular ²						12, 570

EAST-BOUND						
23.....	213					213
20 to 22.....	4, 130	50		66		4, 246
18 to 20.....	2, 718	13		171		2, 902
16 to 18.....	597	11		46		654
14 to 16.....	408	13		14		435
12 to 14.....	567	9		2		578
Less than 12.....	551	252		106	481	1, 390
Total.....	9, 184	348		405	481	10, 418
Total net registered tonnage.....	34, 845, 421	52, 618		1, 021, 077	539	36, 319, 655
Passengers:						
Excursion ²						13, 876
Regular ²						12, 753

¹ Includes 4,350 passages by 125 steamers, 12 motor vessels, 27 barges, and 4 motorboats, foreign register, net registered tonnage of which is 388,623. (Includes 296 passages by 6 steamers, 4 motor vessels U. S. Government owned.)

² Includes 11,834 west-bound and 12,038 east-bound passengers carried by vessels of foreign register.

23. Plate III,¹ herewith, shows in graph form, the total net registered tonnage of vessels passing through the St. Marys Falls canals during each year of the period 1910 to 1940, inclusive. It will be noted that the net registered tonnage passing in 1940 was the maximum of record and exceeded by about 5 million tons the tonnage that passed in 1929, the year in which the maximum freight tonnage of record passed through the canals. This is explained by the fact that lake stages in 1929 were unusually high, exceeding the stages in 1940

¹ Not printed.

by about 3 feet, and these high lake stages permitted loading to deeper draft.

24. Plates IV and V,¹ herewith, show, in graph form, the number of passages through the locks of the St. Marys Falls canals during each year of the period 1910 to 1940, inclusive, and the number of lockages of each lock during the same period. The trend toward deeper drafts is illustrated by the preponderance of passages through the Davis and Fourth locks shown by these graphs.

25. The Coastwise Load Line Act of August 7, 1935, established load lines for merchant vessels of 150 gross tons or over loading at or proceeding to sea from any port on the Great Lakes. These load lines are fixed by the Secretary of Commerce to insure sufficient freeboard, buoyance, and stability for the safety of the vessel. The load lines are marked on the hull of the vessels and the vessel cannot be loaded to submerge the load lines without incurring severe penalty. In determining the load line for any vessel consideration is given to its design, age, and general seaworthiness, and to the class of trade in which the vessel is used. The following table shows the number of Great Lakes vessels of American registry for which load line drafts of 21 feet 6 inches or more have been established:

Number of Great Lakes vessels of American registry having maximum allowable drafts (statutory load line limits) of 21 feet 6 inches or over (by inches) as of Jan. 1, 1941

Feet.....	21						22											23						
Inches Number of vessels...	6	7	8	9	10	11	0	1	2	3	4	5	6	7	8	9	10	11	0	1	2	3	4	5
	10	10	5	18	5	8	6	5	2	3	---	2	1	2	---	---	---	---	1	---	---	---	---	---

The 78 vessels included in the above table could be loaded to their load line limit at all times if a deeper lock is provided at the St. Marys Falls Canal.

SURVEY

26. The accompanying map in two sheets was prepared from maps and other data on file in this office, from charts of the United States Lake Survey, and from other reliable sources. As a part of recent field investigations in connection with studies for a new lock at St. Marys Falls Canal, a sounding and probing survey was made to determine the quantity and character of materials that would need to be excavated from the bottom of the South Canal and adjacent areas involved in the proposed replacement of the Weitzel lock and in the deepening of the upper and lower approach channels. The investigations indicate that the materials to be excavated in the upper approach channel are overburden and rock, and that the material to be excavated from the lower approach channel is rock. Materials encountered on the south side of the upper approach channel include fast land overlying rock.

PLAN OF IMPROVEMENT

27. One plan of improvement is considered in detail in this report. This plan includes removal of the Weitzel lock and replacing it with a new lock 800 feet long, 80 feet wide, and having depths of 30 feet;

reconstruction of south pier from the upper end of the lock to Magazine Street, a length of 600 feet; reconstruction of the nose piers between the present Weitzel and Poe locks; reconstruction of east pier in the lower approach channel for a length of 750 feet; and dredging the upper and lower approach channels to a depth of 25 feet. Consideration was given to the construction of a new lock on the site of the Poe lock, but the Weitzel site is very much to be preferred from the standpoint of uninterrupted traffic, a factor which is paramount in importance under present circumstances.

28. The first cost of the plan of improvement has been estimated as set forth in the following tabulation:

First cost of plan of improvement considered

Lock construction: New lock complete, including removal of Weitzel lock, to provide 30 feet over lower breast wall and dredging inside the cofferdam to 3 feet.....	\$4, 400, 000
Pier reconstruction:	
South pier, from upper end of lock to Magazine St., length 600 feet.....	125, 000
East and west nose piers, between Weitzel and Poe locks.....	125, 000
East pier, in lower approach channel, length 750 feet.....	275, 000
Approach channel improvement:	
Upper approach channel, dredging to 25 feet, 100,000 cubic yards ledge rock and overburden at \$5.....	500, 000
Lower approach channel, dredging to 25 feet, 103,000 cubic yards ledge rock at \$5.....	515, 000
Engineering and contingencies (about 10 percent).....	594, 000
Total estimated first cost of improvement.....	6, 534, 000

AIDS TO NAVIGATION

29. The proposed improvement of replacing the present Weitzel lock with a new lock of the dimensions considered herein would not involve the establishment of additional aids to navigation or alteration of present aids to navigation for the existing project.

ANALYSIS OF ECONOMIC JUSTIFICATION OF PROPOSED IMPROVEMENT

30. *Cost of proposed improvement.*—The estimated appropriation of public funds necessary for the execution of the improvement to the existing project as outlined in the plan of improvement is \$6,534,000, as shown in the following table. Appropriation of additional funds for the subsequent maintenance of the project will be necessary only to the extent required for maintenance and operation of the new lock, estimated at \$100,000 per year, since provision of the proposed approach channels would not increase maintenance operations over those required for the existing project; and the Weitzel lock, which will be replaced by the proposed new lock, has not been operated since 1918. The economic analysis of the plan of improvement considered follows:

Investment costs and annual charges

Investment costs:

(1) Federal investment:	
(a) Lock construction.....	\$4, 400, 000
(b) Pier reconstruction.....	525, 000
(c) Approach channel improvement.....	1, 015, 000
(d) Engineering and contingencies (10 percent).....	594, 000

Total first cost..... 6, 534, 000

Investment costs and annual charges—Continued

Investment costs—Continued.

(2) Interest during construction, 3 percent per annum for one-half period of construction-----	\$196, 000
Total investment-----	6, 730, 000

Annual carrying charges:

(1) Federal annual carrying charges:	
(a) Interest at 3 percent on total investment-----	201, 900
(b) Amortization of obsolescence and depreciation at 3 percent, sinking fund:	
Machinery and lock gates (25-year life at 2.74 percent, on \$927,000)-----	25, 420
Lock structure (40-year life at 1.33 percent on \$5,803,000)-----	77, 180
(c) Increased cost of operation and maintenance of structures-----	100, 000
Total annual charges-----	404, 500

31. *Benefits that may be expected to accrue from the proposed improvement.*—The specific benefits that are expected to accrue from provision of the improvement considered herein include:

(a) Benefits to shipping interests:

(1) The estimated saving in time now lost by deep-draft vessels while waiting for lockages at the canal, which lost time would be eliminated by the provision of an additional lock of suitable dimensions to pass the large deep-draft vessels now in use on the Great Lakes.

(2) Elimination of hazards resulting from congestion of all down-bound deep-draft vessels in the North Canal, by providing for the passage of at least part of such vessels through the South Canal to the proposed new lock.

(3) Increase in tonnage carried by deep-draft vessels which cannot now pass through the Soo Locks when loaded to their maximum capacity or loaded to sufficient depth to fully utilize available depths in the through connecting channels.

(b) Benefits contributing to national defense:

(1) Assurance of sufficient locking capacity for uninterrupted transportation during the navigation season, of materials vital to national defense.

(2) Provision against possible interruption of all deep-draft vessel passages by sabotage or enemy attack from the air, by constructing the proposed new lock as far as possible away from the existing Davis and Fourth locks; thus minimizing the possibility of all major locks being put out of commission by a single large-caliber bomb; and by provision for better protection of machinery, gates, and other vital parts of the proposed new lock, from sabotage and attack.

32. The four locks now in operation at St. Marys Falls Canal are considered capable of passing about 100,000,000 tons of freight per season of about 7 months without material delay to vessels, when the water surface is at datum. Two of the four locks—the Davis and Fourth locks—on the American side are required to pass all of the vessels loaded to a depth greater than 16 feet, since the Poe lock and the Canadian lock have a depth of only 16.6 feet over their lower sills. The narrow width of the Canadian lock prevents the passage of a number of the large type lake freighters even without cargo.

33. During the 1940 season the traffic through St. Marys Falls Canal amounted to 89,858,319 tons of freight, of which 77,061,728 tons moved down-bound. The principal commodity was iron ore and amounted to 66,226,030 tons. Iron ore brought from Lake Superior constitutes the principal supply for the steel industry of the United States. An uninterrupted flow of this commodity is of great importance to the United States in peacetime and of paramount importance in times of national emergency. Railroad facilities for moving a large percentage of this commodity from Lake Superior mines to the lower Great Lakes ports or furnaces are inadequate, and could not be made available in time to be of assistance in alleviating an emergency.

34. The peacetime movement of freight through St. Marys Falls Canal during 1929 amounted to 92,622, 017 tons and in 1916, during the last national emergency, amounted to 91,888,219 tons. There are good reasons to believe that all previous records will be broken in 1941 and that the capacity of the locks will be taxed.

35. The seriousness of the situation may be best pointed out by the fact that of the entire freight movement in 1940 (89,858,319 tons), 77,061,728 tons moved down-bound and had to be passed through the Davis and Fourth locks. In addition, a large share of the up-bound tonnage (12,796,591 tons) was transported in vessels which were loaded to a depth that prevented their using either the Poe or Canadian lock. Of the 20,837 passages recorded, approximately 60 percent had to use the Davis or Fourth lock. Therefore complete reversals in lock operations predominate in all four locks, at times adding to the time of operations and delays to vessels.

36. The approved project provides for a minimum depth of 25 feet in the down-bound channels and a minimum depth of 20 feet in the up-bound channels of the Great Lakes. The existing depth of 23.1 feet over the lower sills of the Davis and Fourth locks is therefore deficient by 1.9 feet. Should the level of Lakes Huron and Michigan fall below the low water datum for an extended period, as it did in 1925 and 1926, the depth in the locks would be likewise adversely affected, and the benefits derived from deepening the channels of the Great Lakes would be nullified to a large degree. It is estimated that 1 foot of draft of the modern ore carrier corresponds to approximately 1,000 tons of freight. The decrease in the carrying capacity of the ore fleet during periods of low water can therefore be measured directly by the lack of depth in the locks.

37. In the prior survey report printed in House Document No. 253, Seventieth Congress, first session, one of the reports being reviewed herein, it is stated that the estimated net economic return from a 24-foot project exceeds the net return from a 22-foot project by \$500,000 per annum. In view of the fact that project depths for 24-foot navigation are now available in the connecting channels for down-bound vessels, except at the Soo locks, where the limiting draft is 21 feet 6 inches, construction of the proposed lock would have the effect of increasing the available draft for through navigation from 21 feet 6 inches to 24 feet, and an estimated \$500,000 margin of annual benefit from the 24-foot navigation project over the benefit from a 22-foot project would be realized.

38. Comparison has been made of the probable loss to vessel interests occasioned by waiting for lockages at the canal. Assuming

that the average loss is one-half hour, that the average cost of operation of a vessel is \$40 per hour, and that 60 percent of all vessels desiring lockage are delayed, the loss would be $0.5 \times 40 \times 20,837 \times 0.60 = \$250,044$ per season. Should either the Fourth or Davis lock be out of commission for an extended period, the loss to shipping interests would pyramid rapidly. If both the Davis and Fourth locks were out of commission, it is estimated that about 65,000,000 tons of freight could be passed through the Poe and Canadian locks on a draft of about 16.5 feet, providing Lake Huron was not below normal stage. The additional delay to all vessels would approximate not less than an hour per lockage. About 25,000,000 to 30,000,000 tons of freight could not be transported by water and the economic loss would be not less than \$50,000,000 annually.

39. The locks at Sault Ste. Marie are therefore of vital economic importance to the Nation at large. During a national emergency they become of still greater importance for the reason that the iron ore needed in national defense could not now be transported by rail from Lake Superior in quantities sufficient to satisfy the demand for the defense program. The iron ore tonnage handled during the past season through the canal (66,226,030 tons) is insufficient to meet the needs for the past summer and coming winter seasons.

40. The depths of 23.1 feet at low water datum in the Davis and Fourth locks restrict the loading of vessels to about 21.6 feet, except when the level of Lake Huron is above datum, since allowance must be made for fluctuations in levels due to storms, squat of vessels, and the necessity of having sufficient water under the hull to float the vessel. There are 294 ships of American registry in the iron-ore fleet, of which 64 vessels are capable of loading to a summer draft of 21 feet or over, but less than 21 feet 6 inches. There are 46 vessels that may load to summer draft of 21 feet 6 inches or over. Thus 110 American vessels are capable of loading to 21 feet or over. In addition, there are a large number of Canadian vessels capable of loading to 21 feet or more, all of which must use the American locks because of the lack of depth and the insufficient dimensions of the Canadian lock. Of the 617 Canadian passages through the American Locks during the past season, the draft of 232 of the vessels required them to use either the Davis or Fourth lock, and 18 additional passages were by Canadian ships having dimensions that exceeded those of the Canadian lock. The Canadian fleet is therefore to a large extent dependent upon the facilities offered by the American locks.

41. The provision of an additional lock in the near future can be further justified because of the advanced age and condition of the Poe lock and Canadian lock. The Poe lock has a floor and culvert system constructed of wood and is 45 years old. The substructure is leaking badly and is showing signs of weakness. The condition of the Canadian lock, put in operation in 1895, is reported to be fair, but because of its dimensions and obsolescence it is incapable of accommodating present shipping requirements. The statistics for 1940 indicate that out of the 89,858,319 tons of freight passed through the four locks only 1,995,377 tons, or less than 2 percent, were passed through the Canadian lock.

42. The older records of the canal are not considered indicative of the present capacity of the four locks, for the reason that the smaller type of cargo carrier is gradually disappearing from the Great Lakes

and is being replaced by a larger type requiring greater depth. It is not believed that any radical increase in dimensions of the cargo carrier will take place for a number of reasons. A lock 800 feet long in the clear and 80 feet wide would appear to be sufficient.

43. When the Weitzel lock was completed in 1881 the average water level over the lower breast wall was 5.8 feet higher than the present low-water datum. Since the completion of the Davis and Fourth locks, the local low-water-datum plane has been lowered 1.4 feet. The gradual recession of water levels of the Great Lakes must therefore also be considered in conjunction with the increased draft of modern ships.

44. *Relation of new lock at St. Marys Falls to national defense.*—The above comments have presented the need for a new lock primarily from the point of view of navigation and the increasing iron ore traffic. The need for this additional lock is even greater as a defense measure. The present locks at St. Marys Falls Canal are considered vulnerable to enemy attack from the air and to possible sabotage on the ground. They were designed and built piecemeal over a long period of years, and, with the possible exception of certain machinery and gates on the Davis and Fourth locks, the parts are not readily interchangeable. Fabrication and replacement of the vital parts would require considerable time and would result in serious interruption to traffic. Consideration should be given to the design of a new lock with provision for better protection of machinery, gates, and other vital parts from sabotage and attack. It is conceivable that a single act of sabotage or a well-placed large-caliber bomb could destroy both the Davis and Fourth locks, as these locks are relatively close together. A new lock constructed on the site of the present Weitzel lock, as considered herein, would be about 400 feet from the Davis lock. Its value in the sense of added insurance against interruption of transportation of materials essential to national defense is obvious.

45. While under normal conditions it would require about 3 years to construct such a lock, as a defense measure it could be constructed in time to be ready for use at about the time the defense effort reaches its peak. If funds are made available promptly, this lock could be completed and put in operation during the 1942 navigation season.

DIFFICULTIES ATTENDING NAVIGATION

46. The difficulties attending commercial navigation in the St. Marys Falls Canals are principally those experienced by deep-draft vessels in locking through the Davis and Fourth locks, through which all vessels loaded to a depth greater than 16 feet must pass. With decreased depth over the sills of the locks, such as results from a fall of the level of Lake Huron, passage through the locks becomes more difficult, and results in delays to down-bound vessels loaded to utilize the available depths in the down-bound through channels.

WATER POWER AND OTHER SPECIAL SUBJECT

47. No questions of water-power development, land reclamation, protection from floods, wildlife preservation, provision of seaplane bases, abatement of pollution, irrigation, or other special features are encountered in the considerations herein.

SHORE LINE CHANGES

48. The site of the proposed lock is about 1 mile below the head of the South Canal, the main banks of which are lined with walls and piers. The shore along the lower approach channel likewise is faced with piers. Since the necessary dredging to provide the required approaches to the proposed lock would consist principally of rock excavation, the proposed improvements would have no effect in the way of erosion or accretion on the adjacent shore lines either above or below the locks.

DISCUSSION

49. The St. Marys Falls Canal and locks comprise one of the most important links in the through channels for transportation of commodities on the Great Lakes because of the magnitude of the iron ore shipments from the Lake Superior region to the lower lakes. The importance of this traffic in peacetimes and its more vital importance in connection with national-defense measures is outlined in preceding paragraphs.

50. *Improvements required.*—The improvement most urgently required by the shipping interests and as a national-defense measure is a new lock 30 feet deep, 80 feet wide, and 800 feet long, with approach channels dredged to a depth of 25 feet. A depth of less than 30 feet is not considered inasmuch as the Welland Canal locks have that depth.

51. *Prospective benefits.*—The prospective benefits that may be expected to accrue in peacetime as a result of the construction of the new lock and approaches considered in the plan of improvement are the savings resulting from the elimination of delays of vessels waiting for lockages at the canal. This lost time is estimated in paragraph 38 to amount to \$250,044 per season. The lost time in the event either the Fourth lock or Davis lock were put out of commission for an extended period of time by accident or other cause would amount to many times the above estimated loss; and the benefit from the removal of such a hazard to shipping, by the insurance which the provision of the proposed lock will afford against interruption of vessel traffic, although not subject to evaluation, likewise would be increased. The existence of the proposed new lock in such a contingency as would arise should both of the present large locks be out of commission for an extended period of time would result in benefits which might exceed many times the first cost of the improvement.

52. The benefits which would accrue to shipping in general in the form of increased use of potential cargo capacity of vessels now limited as to draft by the depth of the existing locks, which use would result in a greater utilization of the improvements provided by the existing project for the connecting channels, are estimated to be \$500,000 annually.

53. *Economic cost of improvement.*—Provision of the improvement proposed will require a total investment of \$6,730,000 (see par. 30), on which the estimated annual carrying charges would amount to \$404,500.

54. *Economic justification.*—The improvement considered herein and outlined in detail in the plan of improvement would provide

ample additional lockage facilities for handling the maximum amount of prospective vessel traffic through St. Marys Falls Canal, based either on the number of lockages, on the maximum allowable draft of vessels engaged in hauling bulk commodities on the Great Lakes, or on the controlling depths in the downbound through channels. Further, by virtue of its location on the site of the present Weitzel lock as far as possible away from the Davis and Fourth locks, the proposed new lock would provide the maximum insurance against the possibility of all large locks being put out of commission at one time. In view of the above, the investment of \$6,730,000 with annual carrying charges of \$404,500 appears to be justified.

55. *Local cooperation.*—Since the proposed improvement would benefit only the through traffic between Lake Superior and the lower Lakes, and since any benefits which might accrue to the locality would be incidental, no local cooperation of any nature in connection with the project is considered warranted.

CONCLUSIONS

56. The foregoing facts and figures indicate that the construction of a new lock, 800 feet long, 80 feet wide, and 30 feet deep, on the site of the present Weitzel lock and its approaches, and the deepening of the approach channels to a depth of 25 feet and the reconstruction of the piers along the approach channels, will result in total annual benefits to navigation, as set forth in paragraphs 37 and 38, totaling \$750,044. Since the anticipated benefits exceed the estimated annual carrying charges (par. 30) by about \$345,500, I am of the opinion that the expenditure involved in providing the proposed improvement is economically justified by the anticipated benefits.

57. In addition to the monetary benefits accruing to shipping interests, the benefits contributing to national defense are of even greater importance, in that the proposed improvements at the site recommended would assure sufficient locking capacity for uninterrupted transportation during the navigation season of materials vital to national defense; and would provide insurance against possible interruption of all deep-draft vessel passages through the canal by sabotage or enemy attack from the air, by minimizing the possibility under present conditions of all major locks being put out of commission, and by providing for better protection of machinery, gates, and other vital parts of the new lock.

RECOMMENDATION

58. For reasons stated in the preceding paragraphs, it is recommended that the existing project for the Great Lakes-connecting waters, principal harbors, and river channels be modified, to provide for a new lock 800 feet long, 80 feet wide, and 30 feet deep, on the site of the present Weitzel lock at St. Marys Falls, Mich.; for the deepening of the upper and lower approach channels to 25 feet; and for the reconstruction of the south pier from the upper end of lock to Magazine Street, of the east and west nose piers between the Weitzel and Poe locks, and of the east pier in the lower approach channel; all as shown on the accompanying drawing (file No. D. S. M. 2/133).

59. It is estimated that the improvement, as recommended herein, will require a total appropriation by the Federal Government of \$6,534,000 for new work, and an increase of \$100,000 per year in the cost of operation and care of St. Marys Falls Canal. It is estimated that the work will require 16 months for completion, if prosecuted as an emergency measure and work carried on through the winter, and that funds in the full amount of the estimated cost for new work (\$6,534,000) should be made available in the initial allotment.

R. G. BARROWS,
Lieutenant Colonel, Corps of Engineers,
District Engineer.

[First endorsement]

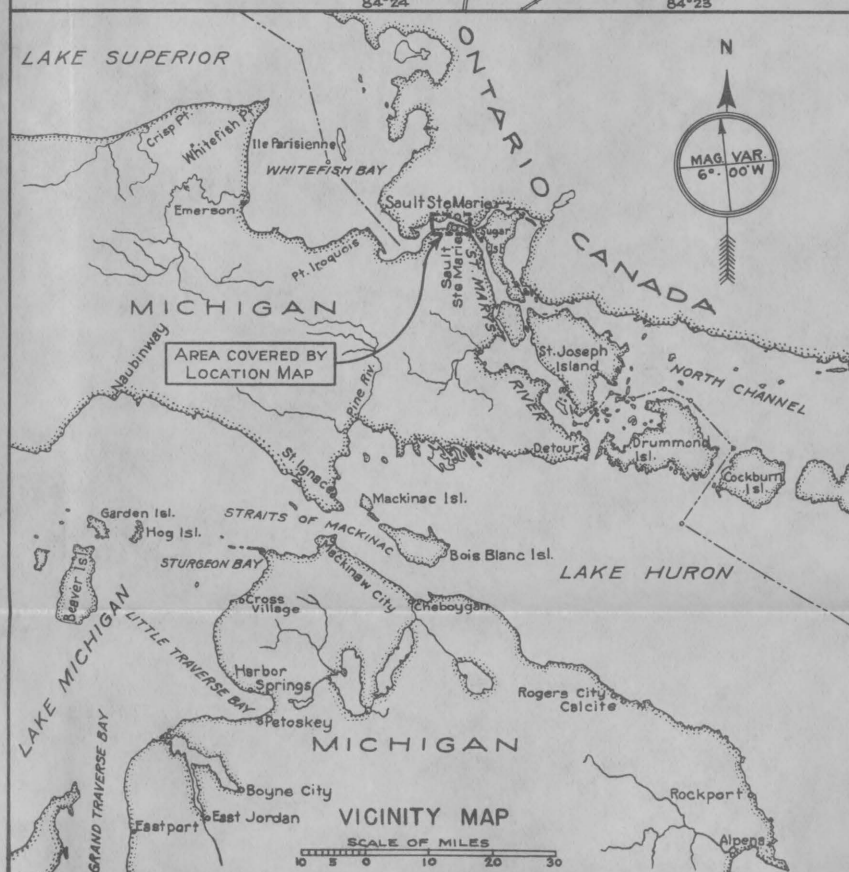
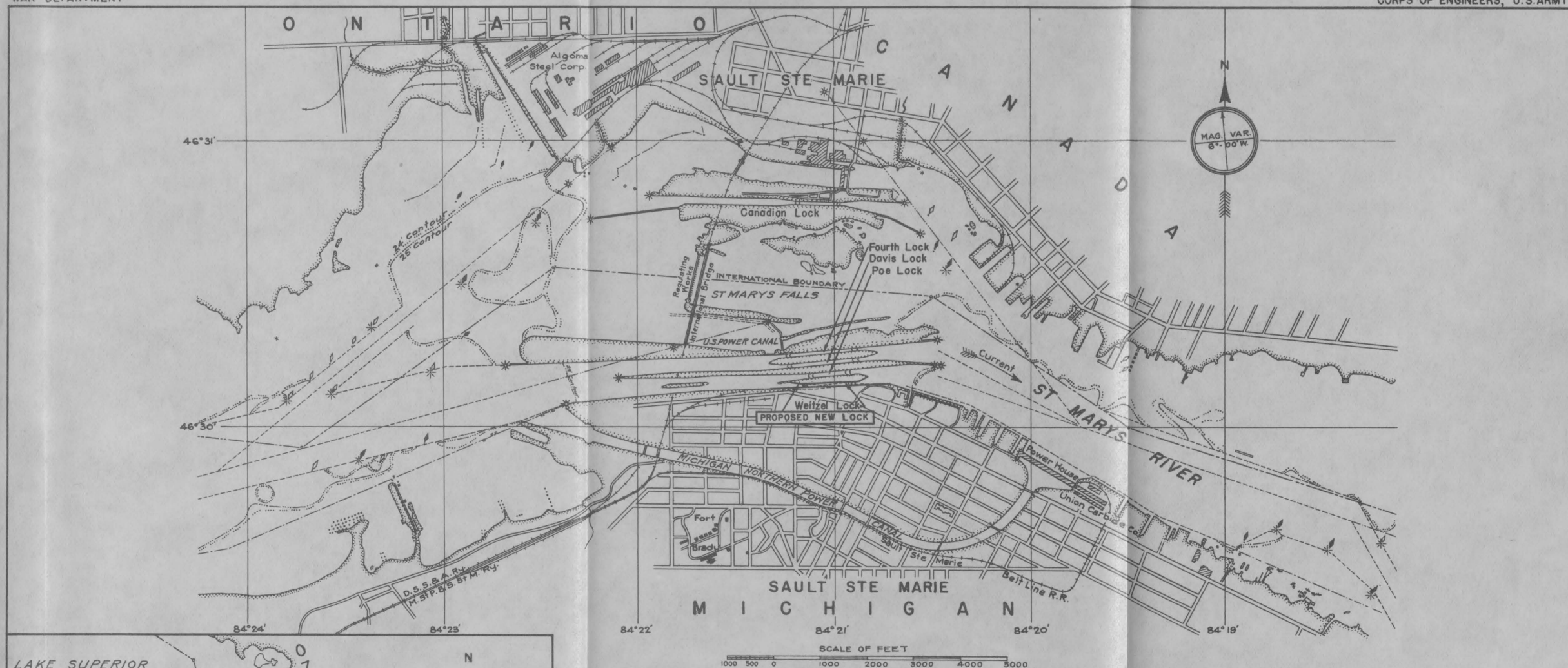
OFFICE DIVISION ENGINEER,
GREAT LAKES DIVISION,
Cleveland, Ohio, February 26, 1941.

To the CHIEF OF ENGINEERS, UNITED STATES ARMY:

The district engineer's recommendation is concurred in.

U. S. GRANT, 3D,
Brigadier General, Army of the United States,
Division Engineer.

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LOCATION PLAN

Contours are referred to Low Water Datum, corresponding to an elevation for the river above the locks of 601.1 feet and for the river below the locks of 579.4 feet above Mean Tide at New York, adjusted levels of 1935.

**ST. MARYS RIVER, MICH.
PROPOSED NEW LOCK
TO ACCOMPANY REVIEW REPORT
DATED FEBRUARY 26, 1941**

In 2 Sheets Sheet No. 1 Scale as shown

U.S. ENGINEER OFFICE, DETROIT, MICHIGAN, FEB. 25, 1941

Submitted:

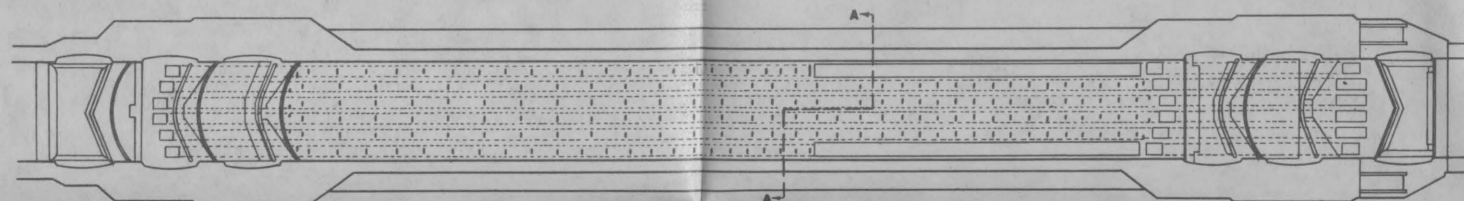
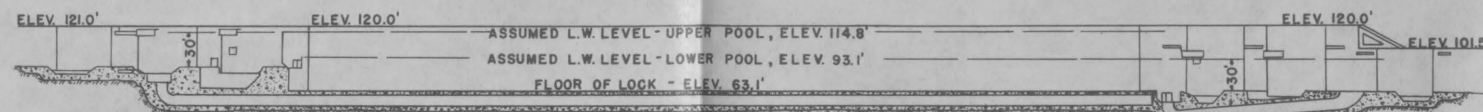
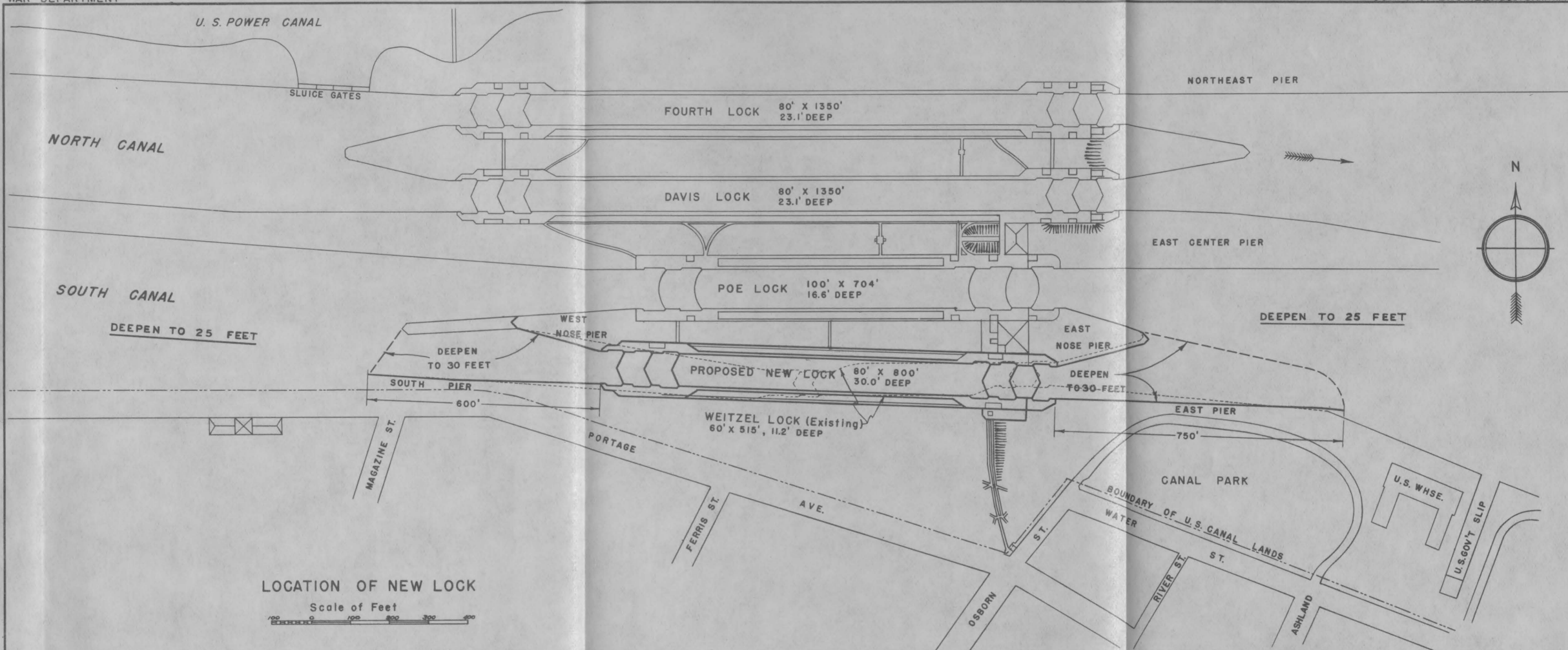
Approved:

John C. Telfer
Sr. Engineer

[Signature]
Lt. Col., Corps of Engineers

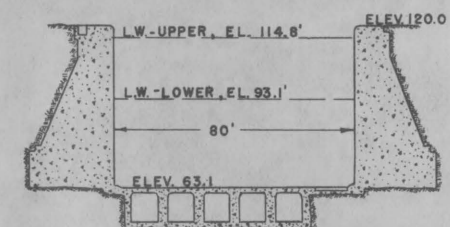
Drawn by W.H.McL.

File No. D.S.M. 2/132



PROPOSED NEW LOCK

Scale of Feet



SECT. A A

Scale of Feet

ST. MARYS RIVER, MICH.
PROPOSED NEW LOCK
 TO ACCOMPANY REVIEW REPORT
 DATED FEBRUARY 26, 1941

In 2 Sheets Sheet No. 2 Scale as shown
 U.S. ENGINEER OFFICE, DETROIT, MICHIGAN, FEB. 25, 1941

Submitted:
Tom C. Telford
 Sr. Engineer

Approved:
W. H. M. ...
 Lt. Col., Corps of Engineers

Drawn by J. McG.

File No. D.S.M. 2/133

Elevations are referred to Canal Datum, zero of which
 is 486.27 ft. above Mean Tide at New York (Levels of 1935)